WHAT IS CLAIMED IS:

1. A projection exposure apparatus for projecting a pattern image formed on a mask onto a photosensitive substrate through a projection optical system to form a projected image thereon, the projection exposure apparatus comprising:

a substrate position detector that detects a position of a registration mark formed on the substrate;

an imagery characteristic correction mechanism coupled with the projection optical system that drives the projection optical system to correct an imagery characteristic of the projection optical system;

an image-forming displacement detector communicating with said imagery characteristic correction mechanism, said image-forming displacement detector determining a displacement amount of an image-forming position of the projected image in accordance with a driven amount of the projection optical system by said imagery characteristic correction mechanism; and

an alignment signal processor communicating with said substrate position detector and said image-forming displacement detector, said alignment signal processor correcting the detection result of the substrate position detector based on the displacement amount of the image-forming position obtained by the image-forming displacement detector.

2. The projection exposure apparatus of claim 1, further comprising a memory storing a relation between the driven amount of the projection optical system by said imagery characteristic correction mechanism and the displacement amount of the image-forming position, said image-forming displacement detector communicating with said memory.

3. The projection exposure apparatus of claim 2, wherein said projection optical system comprises the mask and at least one optical element that projects the pattern image formed on the mask onto the photosensitive substrate, said imagery characteristic correction mechanism having a driving device coupled to the mask and said optical element, said driving device driving or tilting at least one of the mask or said optical element along an optical axis direction of the projection optical system or with respect to a plane perpendicular to the optical axis.

4. The projection exposure apparatus of claim 2, further comprising a pressure adjustment mechanism communicating with said imagery characteristic correction mechanism, said projection optical system comprising at least two optical elements disposed along the optical axis, said optical elements defining a sealed space therebetween, wherein said imagery characteristic correction mechanism controls said gas pressure adjustment mechanism to change a gas pressure in said sealed space.

5. The projection exposure apparatus of claim 1, wherein said projection optical system comprises the mask and at least one optical element that projects the pattern image formed on the mask onto the photosensitive substrate, said imagery characteristic correction mechanism having a driving device coupled to the mask and said optical element, said driving device driving or tilting at least one of the mask or said optical element along an optical axis direction of the projection optical system or with respect to a plane perpendicular to the optical axis.

6. The projection exposure apparatus of claim 1, further comprising a pressure adjustment mechanism communicating with said imagery characteristic correction mechanism, said projection optical system comprising at least two

optical elements disposed along the optical axis, said optical elements defining a sealed space therebetween, wherein said imagery characteristic correction mechanism controls said gas pressure adjustment mechanism to change a gas pressure in said sealed space.

7. The projection exposure apparatus of claim 1, further comprising at least one displacement detector secured to the projection optical system and communicating with said image-forming displacement detector, said displacement detector detecting the driven amount of the projection optical system by said imagery characteristic correction mechanism.

8. The projection exposure apparatus of claim 1, further comprising an environmental sensor disposed adjacent the projection optical system and communicating with said imagery characteristic correction mechanism.

9. A projection exposure apparatus for projecting a pattern image of a mask through a projection optical system onto a photosensitive substrate to form a projected image thereon, the projection exposure apparatus comprising:

a substrate position detector that detects a position of a registration mark formed on the substrate;

an imagery characteristic correction mechanism coupled with the projection optical system that drives the projection optical system to correct an imagery characteristic of the projection optical system;

a base-line amount measuring device that measures a distance between a detection center of said substrate position detector and a center of the projected image formed through the projection optical system, said distance defining a base-line amount; and

an alignment signal processor communicating with said substrate position detector and said base-line amount measuring device, said alignment

signal processor correcting the detection result of the substrate position detector based on the base-line amount.

10. The projection exposure apparatus of claim 9, wherein said base-line amount measuring device comprises a reference plate disposed adjacent and substantially level with the photosensitive substrate, said reference plate including primary alignment marks corresponding to alignment marks on the mask.

11. The projection exposure apparatus of claim 10, wherein said reference plate includes a secondary alignment mark disposed adjacent said substrate position detector during initial alignment, said substrate position detector determining an offset amount in accordance with a distance between a center point between said primary alignment marks and said secondary alignment mark.

12. The projection exposure apparatus of claim 10, wherein said base-line amount measuring device further comprises a pair of mask alignment microscopes, said mask alignment microscopes being disposed adjacent the alignment marks on the mask for detecting the alignment marks on the mask.

13. A method of projecting a pattern image formed on a mask onto a photosensitive substrate through a projection optical system having an optical axis to form a projected image thereon, the method comprising:

(a) detecting with a substrate position detector a position of a registration mark formed on the substrate;

(b) driving the projection optical system to correct an imagery characteristic of the projection optical system;

(c) determining a displacement amount of an image-forming position of the projected image formed through the projection optical system in

accordance with a driven amount of the projection optical system in step (a); and

(d) correcting the detected position from step (a) based on the displacement amount.

14. The method of claim 13, wherein a memory stores a relation between the driven amount of the projection optical system and the displacement amount of the image-forming position, said step (c) being practiced by accessing the displacement amount stored in the memory in accordance with the driven amount.

15. The method of claim 14, wherein step (b) is practiced by driving or tilting at least one of the mask or an optical element of the projection optical system along an optical axis direction of the projection optical system or with respect to a plane perpendicular to the optical axis.

16. The method of claim 14, wherein step (b) is practiced by controlling a gas pressure in a space defined by optical elements of the projection optical system.

17. The method of claim 13, wherein step (b) is practiced by driving or tilting at least one of the mask or an optical element of the projection optical system along an optical axis direction of the projection optical system or with respect to a plane perpendicular to the optical axis.

18. The method of claim 13, wherein step (b) is practiced by controlling a gas pressure in a space defined by optical elements of the projection optical system.

19. The method of claim 13, wherein step (c) is practiced by, prior to step (b), measuring a distance between a detection center of the substrate position detector and a center of the projected image formed through the projection optical system defining a base-line amount, and after step (b), again measuring the base-line amount.

20. The method of claim 19, wherein a base-line amount measuring device for measuring the base-line amount includes a reference plate disposed adjacent and substantially level with the photosensitive substrate, the reference plate including primary alignment marks corresponding to alignment marks on the mask and a secondary alignment mark disposed adjacent the substrate position detector during initial alignment, wherein step (c) is further practiced by determining an offset amount in accordance with a distance between a center point between the primary alignment marks and the secondary alignment mark, and adding the offset amount to the base-line amount.

21. The method of claim 13, further comprising, prior to step (a) the step of (e) aligning the mask with respect to the projection optical system.

22. The method of claim 21, wherein step (e) is practiced by:

(e1) detecting positions of projected images of at least two alignment marks formed on the mask, the alignment marks having a predetermined positional relationship with the pattern image;

(e2) changing a magnification of the projection optical system;

(e3) detecting the positions of the projected images after step (e2); and

(e4) adjusting the mask position based on the positions of the projected images determined in steps (e1) and (e3).

23. The method of claim 22, further comprising the step of repeating steps (e1) through (e4) until a center of the pattern image projected onto the photosensitive substrate is aligned with the optical axis even after the magnification of the projection optical system has been changed.

24. The method of claim 22, comprising the steps of replacing the mask with a second mask and positioning the second mask in the same position as the first mask based on mask position information obtained in step (e4).

25. The method of claim 24, wherein the mask position information is a position of a reference mark corresponding to the mask position adjusted in step (e4).

26. The method of claim 24, wherein the mask position information is information supplied from a mask position adjusting mechanism during the mask adjustment performed in step (e4).

27. A mask alignment method for aligning a mask with respect to a projection optical system having an optical axis prior to transferring a pattern image of the mask onto a photosensitive substrate through the projection optical system, the method comprising:

(a) detecting positions of projected images of at least two alignment marks formed on the mask, the alignment marks having a predetermined positional relationship with the pattern image;

(b) changing a magnification of the projection optical system;

(c) detecting the positions of the projected images after step (e2); and

(d) adjusting the mask position based on the positions of the projected images determined in steps (a) and (c).

28. The method of claim 27, further comprising the step of repeating steps (a) through (d) until a center of the pattern image projected onto the photosensitive substrate is aligned with the optical axis even after the magnification of the projection optical system has been changed.

29. The method of claim 27, comprising the steps of replacing the mask with a second mask and positioning the second mask in the same position as the first mask based on mask position information obtained in step (d).

30. The method of claim 29, wherein the mask position information is a position of a reference mark corresponding to the mask position adjusted in step (d).

31. The method of claim 29, wherein the mask position information is information supplied from a mask position adjusting mechanism during the mask adjustment performed in step (d).